



BS4142 Noise Assessment

Report No: 2098-R1 – Air Handling & Refrigeration Equipment – CoCoRo, 25 Coptic Street, London.

Client: - Kayoko - CoCoRo

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<p><u>Report Revisions</u></p> <p>2098-R1 – 22/08/13 – Initial Report</p> <p>2098-R2 03/09/2013 – Mitigation treatment added – Corrected background value for light well area</p>

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1. Introduction

Clover Acoustics has been appointed by Kayoko of CoCoRo to carry out a BS4142 noise assessment on an installation of air handling and refrigeration equipment at 25 Coptic Street, London, WC1A 1NT. It is understood that the local authority has requested an acoustic assessment of the proposed system installed to the rear flat roof and light well area of the property as part of an application for restaurant use.

The purpose of this report is to demonstrate that due consideration for noise from the combined systems affecting any neighboring sensitive properties, in this case residential, has been taken and to see that there is no significant impact to these properties through identifying necessary levels of attenuation.

2. Site Description

25 Coptic Street is a mid-terraced property in a mixed residential and commercial area of London. The proposed restaurant will operate from the ground floor of the property with residential to the upper floors.

Kitchen extract intake equipment, an air conditioning unit and a refrigeration unit are installed but not commissioned on a flat roof area identified below. The flat roof area looks out onto a courtyard with residential units surrounding. There is a presumed residential property adjacent to the equipment some four meters away which is assumed to be the nearest sensitive receiver for this assessment. Historically the area has previously been used to house air handling equipment and it is believed the building itself has previously been utilized as restaurant.

The extract unit and extract fan case are to be situated in a light well away from the main equipment. The extract exhaust will terminate at roof level however the fan casing is to be situated approximately 1 meter from a residential window, believed to be a bedroom. There is existing redundant ducting in the light well which it is understood will be utilized for the extract. The light well houses several extracts and air conditioning units and the local noise climate reflects this.

The hours of operation for the restaurant are yet to be confirmed although licensing has been granted for late night refreshments for 10:00 – 23:30 Monday – Saturday and 11:00 – 22:30 Sunday. Air handling, refrigeration and kitchen extract equipment will run intermittently throughout this period. The refrigeration unit may potentially activate during the night time period where required and this has been considered for the flat roof area assessment. It is expected that the extract and outtake casing fan in the light well area will

cease operation at the closing time of the business and as such will be assessed against the lowest operational hour background.

The predominant noise on site was noted to be from the existing roof mounted plant, road traffic and general background noise from the surrounding area. Figure 1 shows the site layout. More pictures can be seen in the Appendix.



Figure 1 – Site Layout (Not to scale)

3. Scope

The scope for this assessment has been made in accordance with the following standards and documents:

- BS4142: 1997 – Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas.
- World Health Organisation – Guidelines for Community Noise 1999 referenced in
- Camden Local Development Framework Policies – Adoption Version 2010:

4. Assessment Methodology

An assessment of noise affecting nearby residences from the air handling and refrigeration installation has been made in accordance with BS4142:1997. Measurements have also been compared with guidance in Camden Local Development framework.

BS4142:1997 Method for Rating industrial noise affecting mixed residential and industrial areas.

BS4142 gives a method for rating noise from industrial sources affecting residential properties. The rating level (this is the specific noise level of the source with any corrections or penalties for tonality) of the noise source is compared to the existing background noise level at the property. The greater the difference between the two, the greater the likelihood for complaints.

- a difference of +10dB indicates that complaints are likely;
- a difference of +5dB is of marginal significance;
- if the rating level is more than 10dB below the measured background noise level, this is a positive indication that complaints are unlikely.

World Health Organisation – Guidelines for Community Noise 1999.

The World Health Organisation gives further guidance for maximum recommended noise levels outside residential properties as follows:

Specific Environment	Critical health effect	dB L_{Aeq}	Time (hr)	dB L_{Amax}
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

Camden Local Development Framework Policies:

Guidelines taken from the document identify in the Camden UDP for industrial noise gives limits for introduced industrial noise sources based upon BS4142 and WHO Guidelines.

Where the predicted noise levels should not exceed 5dB above background, or if a distinctive acoustic characteristic is present then a further 5dB penalty requires the introduced noise source to not exceed 10dB below the existing background expressed as L_{A90} . Where the background noise levels are above 60dB the introduced noise levels should be not exceed 55dB L_{Aeq} .

Table E: Noise levels from plant and machinery at which planning permission will not be granted

Noise description and location of measurement	Period	Time	Noise level
Noise at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	5dB(A) <LA90
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise at 1 metre external to sensitive façade where LA90>60dB	Day, evening and night	0000-2400	55dB _{LAeq}

Key references / evidence

- Camden's Noise Strategy, 2002
- The London Plan (Consolidated with Alterations since 2004), 2008
- Planning Policy Guidance 24: Planning and noise

Figure 2 – Taken from Camden Local Development Framework Policy page 109

5. Survey Information

Unattended monitoring at the property was undertaken between Tuesday 13th August 2013 and Wednesday 14th August 2013 to provide background noise (dB L_{A90}), and residual noise (dB L_{Aeq}) data for this assessment. A background monitoring period has been selected for the assessment as a worst-case scenario when background levels are expected to be lowest.

This report will specify the required mitigation levels to enable design of the proposed air handling and refrigeration system to be completed.

Measurement Instrumentation

The measurement instrumentation used on the survey was as follows:

Equipment	Manufacturer & Type	Serial Number
Sound Level Meter	Norsonic 118	30559
Sound Level Meter	Norsonic 118	28952
Acoustic Calibrator	Norsonic 1251	32856

The equipment was calibrated to comply with section 4.2 of BS7445:1-2003 before and after the surveys. The calibration was as follows:

Meter	Serial	Before		After	
Norsonic 118	28952	113.9	-26.0	113.9	-26.0
Norsonic 118	30559	113.8	-26.1	113.8	-26.1

Measurements & Timescales

During the 24-hour survey 5-minute measurements were made. The following measurements are reported: L_{Aeq,5mins}, L_{A90,5mins}

The measurements and their interpretation shall be in accordance with BS 7445: Parts1 and 2. All sound pressure levels are in dB (re 20µPa).

Meteorology

During the survey visits the weather was considered to be dry and mild with no discernable wind speed.

Position of Monitoring Equipment

During the survey the equipment was positioned on the flat roof at a location considered representative of the background and ambient noise level at the nearest residential window. Further, the secondary equipment was positioned at a location in the light well considered representative of the background and ambient condition at the nearest residential receiver for that location. Façade corrections of -3dB have been included.

6. Survey Results

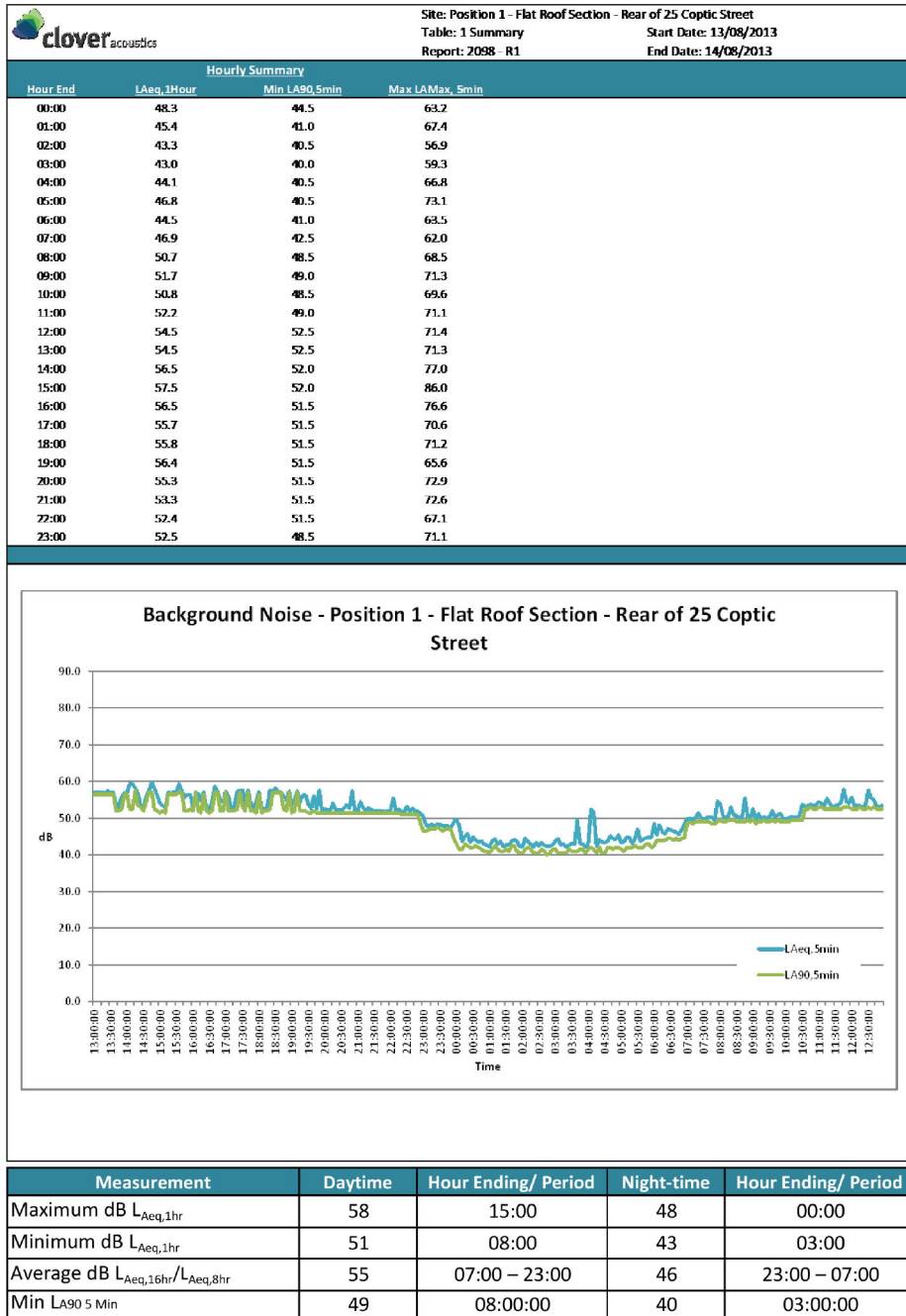
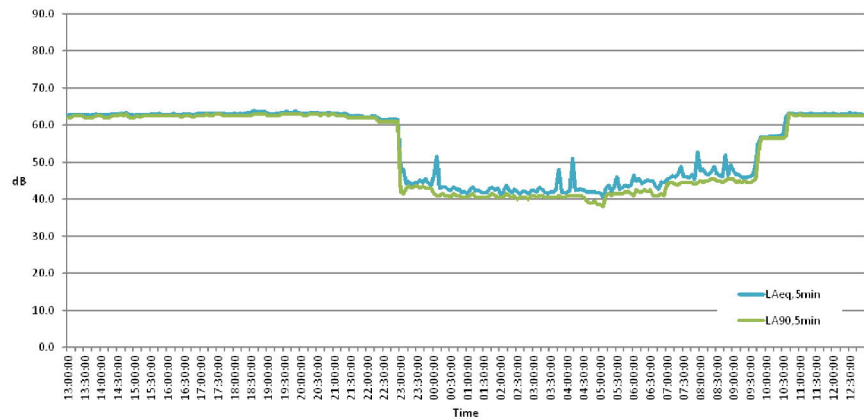


Table 1 – Background data for the flat roof section

Hourly Summary

Hour End	L _{Aeq,1Hour}	Min L _{A90,5min}	Max L _A Max, 5min
00:00	45.4	41.5	70.9
01:00	44.9	40.5	71.1
02:00	42.4	40.5	56.9
03:00	42.2	40.0	55.1
04:00	43.1	40.5	65.4
05:00	44.1	38.5	66.3
06:00	43.3	38.0	64.0
07:00	44.8	41.0	60.7
08:00	47.4	44.0	70.6
09:00	48.0	44.5	65.4
10:00	51.7	44.5	66.4
11:00	60.5	56.5	70.2
12:00	63.0	62.5	71.1
13:00	63.0	62.5	69.7
14:00	62.7	62.0	67.0
15:00	62.9	62.0	68.2
16:00	62.8	62.0	70.1
17:00	62.9	62.0	69.8
18:00	63.1	62.5	67.4
19:00	63.4	62.5	71.3
20:00	63.3	62.5	74.7
21:00	63.2	62.5	67.7
22:00	62.7	62.0	68.1
23:00	61.8	61.0	68.8

Background Noise - Position 2 - Light Well Section - Rear of 25 Coptic Street



Measurement	Daytime	Hour Ending/ Period	Night-time	Hour Ending/ Period
Maximum dB L _{Aeq,1hr}	63	19:00	45	00:00
Minimum dB L _{Aeq,1hr}	47	08:00	42	03:00
Average dB L _{Aeq,16hr} /L _{Aeq,8hr}	62	07:00 – 23:00	44	23:00 – 07:00
Min L _{A90,5min} - Operational Hours	45	10:00:00	42	00:00:00

Table 2 – Background data for the Light Well section

7. Assessment

BS4142:1997 Method for Rating industrial noise affecting mixed residential and industrial areas.

To complete a BS4142 assessment a specific noise level for the source is required. In this instance the purpose of the report is to specify a specific noise level that will ensure local authority criterion are achieved. The nature of air handling equipment dictates that a distinctive acoustic characteristic will be present and as such it is felt that an overall level of 10dB below background would be in line with the requirements of Camden Council. Both areas of the installation are separated by a building and will be considered individually. Further, the flat roof section has a refrigeration kit that may activate throughout the night and the assessment will therefore consider the lowest (i.e.) worst case night time background levels for that section. The light well equipment will run during operational hours only and will be considered in that light.

In both cases the assessment will identify the required attenuation to ensure the equipment achieves a rating level in line with Camden Council guidance identified in section 4 of this report.

Flat Roof Section

Equipment installed but not yet commissioned within the flat roof area comprises of:

- Hitachi Air Conditioning Unit RAS-6HVRNM2E
- Maxcold refrigeration Unit NFR250DL
- Helios Gigabox Air Intake casement GBW 500/4

Noise levels have been taken from the manufacturers published technical data for each unit which is included in the Appendix to this report. The Hitachi unit has published figures of 48dB @ 1 meter; the Maxcold unit has published figures of 43dB @ 10 meters and has been corrected to 63dB @ 1 meter for the purpose of the assessment. The Helios Gigabox unit has published figures of 45dB @ 4 meters and has been corrected to 57dB @ 1m for the purpose of this assessment. Taking a situation where all units are operating simultaneously it can be seen that overall levels of 64dB are calculated for the specific source.

The nearest receiver window¹ with line of sight is approximately 4m from the source, distance attenuation of -12dB can be calculated using the following formula:

$$L_{p2} = L_{p1} + 20 \log \left(\frac{r_1}{r_2} \right)$$

¹ Taken as upper floor bedroom

Taking all units running simultaneously the lowest case background $L_{A90,5min}$ recorded throughout the operating period was 44dB(A) for the hour ending midnight. It can be seen from this that the performance requirements of the proposed equipment would need to be 46dB(A) @ 1m to ensure a level of -10dB below background² at the façade of the nearest sensitive receiver during the hours of operation.

BS4142 Assessment	dB(A)
Specific	64
Distance Attenuation	-12
Rating Level	52
Lowest Operational LA90	44
Target -10dB below LA90	34
Additional Attenuation Required	18

Table 3 - All equipment Flat Roof Operational Hours

As the refrigeration unit may run throughout the night the lowest case background $L_{A90,5min}$ recorded throughout period was 40dB(A). Taking this as a worst case and assuming the refrigeration unit only is operational then It can be seen from this that the performance requirements of the proposed equipment would need to be 42dB(A) @ 1m to ensure a level of -10dB below background including the penalty correction at the façade of the nearest sensitive receiver during the hours of operation.

BS4142 Assessment	dB(A)
Specific	63
Distance Attenuation	-12
Rating Level	51
Lowest night time LA90	40
Target -10dB below LA90	30
Additional Attenuation Required	21

Table 4 – Fridge only Flat Roof Night time

Discussion:

Additional attenuation of 21dB(A) has been specified for the equipment on the flat roof area in order for the system to be rated -10dB below existing background levels. It is understood that the client preferred treatment option is to box the units with an arrangement of 18mm

² Including acoustic characteristic correction

plywood stud boxing with mineral wool infill. A single sheet of 18mm ply has an R_w of 27dB³ and as such the dual sheet arrangement identified as the clients preferred treatment method will in our opinion provided sufficient acoustic attenuation. Care should be taken to ensure the correct airflow to the equipment and reference to the manufacturers should be made in this respect.

Light Well Section

Equipment installed but not yet commissioned within this are comprises of:

- Helios Gigabox GBD 630/4
- Extract outlet for GBD 630/4

Noise levels have been taken from the manufacturers published technical data for each unit which is included in the Appendix to this report. The Helios Gigabox unit has published figures of 48dB @ 4 meters and have been corrected to 60B @1m for the purpose of this assessment. The Helios outlet has published figures of 85dBL_{WA} and can be calculated to a sound pressure level of 58dB using the formula:

$$L_{p1} = L_w - 20 \log r - 11$$

Where the distance from the outlet to the window of the nearest receiver is taken as 6m for the purpose of this assessment, this gives an overall level at the receiver of 62dB.

BS4142 Assessment	dB(A)
Specific	62
Distance Attenuation	0
Rating Level	62
Lowest Operational LA90	42
Target -10dB below LA90	32
Additional Attenuation Required	30

Discussion:

Additional attenuation of 30dB has been identified for the extract outlet above the roofline of the light well area. This has been discussed with the system installer and it is understood can be achieved with the inclusion of 2 x RSD 630 x 1200 inline silencers in order for the system to be rated -10dB below existing background levels. It is understood that the gigabox fan is to be moved to a distance of ~3m and boxed in 18g galvanized steel sheet. This

³ Original figures from BB51 published in 1976 reproduced in BB93 SRI and Absorption coefficient datasheet

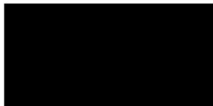
material has an R_w of 29dB and as such will in our view sufficiently attenuate the repositioned unit. It would be prudent to include a mineral wool lining in the construction. Care should be taken to ensure the correct airflow to the equipment and reference to the manufacturers should be made in this respect.

It should be noted that with regard to the light well area the existing background drops off sharply at hour end 23.00 as existing equipment not related to the operation of the proposed restaurant is turned off. The L_{A90} comparison between hour end 23.00 and the stated preferred operational hour end of 23.30 is significant, falling from 61dB L_{A90} to 41.5dB L_{A90} . As such if the client chose to end extract operation no later than 23.00 then attenuation measures in the light well area could potentially be reduced to 1 inline attenuator and Muftilag of the repositioned Gigabox.

8. Conclusion

Clover Acoustics has undertaken a noise assessment at the site the proposed restaurant on 25 Coptic Street, London with regard to an installation including air conditioning plant, refrigeration plant and kitchen extract plant in both a flat roof area and light well area. The assessment has been carried out following the assessment methodology in BS4142:1997. Attenuation measures have been identified to ensure the installation achieves -10dB below the existing background in accordance with the requirements of Camden Council UDP Policy

Any attenuation applied should be referred to the equipment manufacturer to ensure adequate ventilation of equipment and safe operating parameters.



Steve Clow MIOA
Acoustic Consultant

9. Appendix

Photo Appendix



Photo 1 – Flat Roof Installation – Receiver just to east of photo



Photo 2 - View to Flat Roof receiver



Photo 3 - View to Light Well



Photo 3 – Existing Equipment in Light Well

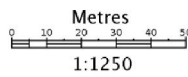
Site Location



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Supplied by: Stanfords
Reference: OI614514
Centre coordinates: 530134 181487

25 COPTIC STREET
LONDON
WC1A 1NT

Technical Information



GigaBox centrifugal fan 630 mm ø



■ Specification

■ Casing

Self-supporting frame construction made from aluminium hollow section. Double skinned, 20 mm strong side panel made from galvanised steel plate, soundproof and heat insulated through coating with non flammable mineral wool. Intake with mouth for ideal inlets as well as connectors and flexible sleeve for installation to ducts.

Extract with spigot (from rectangular to circular) for low-loss escape and flexible sleeve for prevention of impact sound transfer. Simple positioning through load hooks as standard.

■ Impeller

Free-wheeling centrifugal high performance impeller with backwards curved polymer blades made from galvanised steel plate, direct powering. Energy-efficient at low noise development. It is dynamical together with the motor to DIN ISO 1940 T.1 – quality grade 2.5.

■ Motor

Maintenance-free external rotor motor in protection to IP 54. Thermal overload protection through built-in thermo contacts. Ball bearings and radio interference-free.

■ Electrical connection

Terminal box on the motor as standard, protection to IP 54.

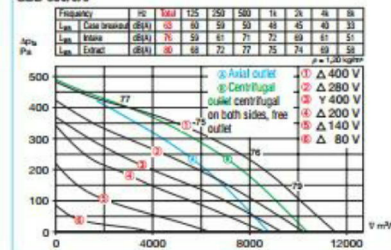
■ Motor protection

Motors have thermal contacts wired to the terminal block and must be connected to a motor protection unit.

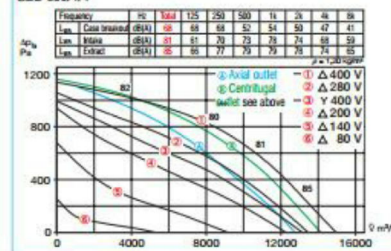
■ Speed control

All models are speed controllable using voltage reduction with transformer controller. The 3 ph.-models can operate on two speed controllers through Y/Δ wiring (accessories to DS 2 or full motor protection unit M4). The voltage steps are given in the performance curve.

GBD 630/6/6



GBD 630/4/4



■ Mounting

Mounting position in any position and flexible installation through five possible discharge directions of the spigot.

For wall mounting the wall bracket has to be used (accessory). It is possible to set up an outlet water repellent roof and grille (accessory).

■ Sound levels

Above the performance curves the sound power levels are given in total and spectrum for:
- sound level case breakout
- sound level intake
- sound level extract
Within the performance curve the sound power level (on intake) is given for the transformer speed steps. In the table below there is also to find
- case breakout level at 4 m (free-field conditions).

■ Accessory

Wall bracket for wall mounting.
GB-WK 630 Ref.No. 5626

Water repellent extract grille.
GB-WSG 630 Ref.No. 5640

Water repellent roof outlet.
GB-WSD 630 Ref.No. 5749

Condensate tray with spigot for duct/ hose connection.
GB-KW 630 Ref.No. 5645

Reversing and on/off switch for double-rotating Y/Δ-switchable 3 Phase fans.
Type DS 2[®] Ref.No. 1351

Type	Ref.No.	Air flow volume (FID)	RPM	Sound press. level case breakout	Motor power	Current full load	Current speed controlled	Wiring diagram	Maximum air flow temperature full load controlled	Nominal weight (ref)	5 step transformer controller with motor protection	Full motor protection unit using the thermal contacts
		m³/h	min⁻¹	dB(A) at 4 m	kW	A	A	No.	°C	kg	Type	Ref.No.
2 speed motor, 3 Phase motor, 3-, 400 V, 50 Hz, Y/Δ-wiring, protection to IP 54												
GBD 630/6/6	5524	9700/1490	630/620	43	0,76/1,35	1,20/2,40	2,40	867	60	60	RDS 4	1316
GBD 630/4/4	5523	13000/1450	1120/1380	48	2,55/3,05	4,50/5,00	7,50	867	75	50	RDS 11	1332

[®] incl. operation and reversing switch.

[®] required full motor protection unit: model FID, No. 5849

500 mm ø GigaBox centrifugal fan



■ Specification ■ Casing

Self-supporting frame construction made from aluminium hollow section. Double skinned, 20 mm strong side panel made from galvanised steel plate, soundproof and heat insulated through coating with non flammable mineral wool. Intake with mouth for ideal inlets as well as connectors and flexible sleeve for installation to ducts. Extract with spigot (from rectangular to circular) for low-loss escape and flexible sleeve for prevention of impact sound transfer. Simple positioning through load hooks as standard.

□ Impeller

Free-wheeling centrifugal high performance impeller with backwards curved polymer blades made from galvanised steel plate, direct powering. Energy-efficient at low noise development. It is dynamical together with the motor to DIN ISO 1940 T.1 – quality grade 2.5.

□ Motor

Maintenance-free external rotor motor in protection to IP 54. Thermal overload protection through built-in thermo contacts. Ball bearings and radio interference-free.

□ Electrical connection

Terminal box on the motor as standard, protection to IP 54.

□ Motor protection

Motors have thermal contacts wired to the terminal block and must be connected to a motor protection unit.

□ Speed control

All models are speed controllable using voltage reduction with transformer controller. The 3 ph.-models can operate on two speed controllers through Y/Δ wiring (accessories to DS 2 or full motor protection unit M4). The voltage steps are given in the performance curve.

□ Mounting

Mounting position in any position and flexible installation through five possible discharge directions of the spigot. For wall mounting the wall bracket has to be used (accessory). It is possible to set up an outlet water

repellent roof and grille (accessory).

■ Sound levels

Above the performance curves the sound power levels are given in total and spectrum for:
– sound level case breakout
– sound level intake
– sound level extract
Within the performance curve the sound power level (on intake) is given for the transformer speed steps. In the table below there is also to find:
– case breakout level at 4 m (free-field conditions).

Type	Ref.No.	Air flow volume (F0)	R.P.M.	Sound press. level case breakout	Motor power	Current full load	speed controlled	Wiring diagram	Maximum air flow temperature full load controlled	Nominal weight (net)	5 step transformer controller with motor protection unit	Full motor protection unit using the thermal contacts
		m³/h	min⁻¹	dB(A) at 4 m	kW	A	A	No.	°C	kg	Type Ref.No.	Type Ref.No.
1 Phase motor, 1–, 230 V, 50 Hz, capacitor motor, protection to IP 54												
GBW 500/6	5519	5700	880	35	0,52	2,30	2,60	864	45	47	MWS 3 1948	TSW 3.0 1496
GBW 500/4	5517	6400	1350	45	1,38	6,40	8,20	805	65	61	MWS 10 1946	–
2 speed motor, 3 Phase motor, 3–, 400 V, 50 Hz, Y/Δ-motor, protection to IP 54												
GBO 500/6/6	5520	4500/5330	545/750	35	0,23/0,42	0,38/0,75	0,78	867	45	45	RDS 1 1314	TSO 0,8 1500
GBO 500/4/4	5518	8000/9850	1075/1340	45	0,97/1,45	1,60/2,80	2,90	867	50	57	RDS 7 1578	TSO 5,5 1503

¹ incl. operation switch

² incl. operation and reversing switch

³ required full motor protection unit: model M4, No. 5849



SPECIFICATIONS - DUCTED INVERTER SYSTEMS

Model: Indoor Unit	RPI-3.0FSN1SQ	RPI-4.0FSN1SQ	RPI-5.0FSN1SQ	RPI-6.0FSN1SQ	RPI-7.0FSN1SQ
Model: Outdoor Unit	RAS-3HVRNS	RAS-4HVRNS	RAS-5HVRNS	RAS-6HVRN	RAS-7HVRN
CAPACITY					
Cooling Capacity (kW)	7.1	9.9	12.5	15.7	18.0
Range (kW)	3.9 ~ 8.0	4.9 ~ 11.2	5.7 ~ 14.0	6.7 ~ 16.0	8.1 ~ 20.0
Heating Capacity (kW)	7.6	10.8	13.6	15.2	18.6
Range (kW)	4.0 ~ 9.0	5.0 ~ 12.5	6.0 ~ 16.0	6.7 ~ 16.0	8.1 ~ 20.0
ELECTRICAL					
Power Supply	240V ac 1 phase 50 Hz				
Power Attachment	IU via OU or IU and OU separately				
Interconnecting Wires	0.75 mm ² x 2 shielded twisted pair				
Running Current RUN / max.	10.8 / 18	14.7 / 22	18.5 / 31	23.2 / 29	26.0 / 31
Recommended External Protection (A)	25	32	40	40	40
EFFICIENCY					
Power Input - Cooling (kW)	2.4	3.5	4.4	5.4	5.9
Power Input - Heating (kW)	2.4	3.1	3.8	4.0	5.4
EER Cooling	2.96	2.85	2.84	2.91	3.05
COP Heating	3.17	3.43	3.58	3.80	3.44
AIRFLOW					
Fan Speeds	3				
External Static Range (Pa)	70 - 120	70 - 120	70 - 120	70 - 120	140
Air Flow (l/s) Hi / Med / Low	484 / 433 / 333	600 / 550 / 417	783 / 717 / 567	933 / 833 / 667	1084 / 950 / 767
Compressor Type	Scroll				
DIMENSIONS & WEIGHTS					
Dimensions IU (H x W x D mm)	350 / 1076 / 800	350 / 1076 / 800	350 / 1300 / 800	350 / 1300 / 800	440 / 1430 / 550
Weight IU (kg)	52	57	61	63	75
Dimensions OU (H x W x D mm)	600 x 792 (+95) x 300	800 x 950 x 370	800 x 950 x 370	1240 x 950 x 315	1650 x 1100 x 390
Weight OU (kg)	44	85	89	97	167
DUCT CONNECTIONS					
Supply Air Connection (mm)	980 x 220	980 x 220	1205 x 220	1205 x 220	830 x 300
Return Air Connection (mm)	813 x 306	813 x 306	813 x 306	935 x 306	1288 x 402
NOISE LEVELS					
Sound Pressure Level IU (dB(A)) Hi / Med / Low	45 / 43 / 39	47 / 44 / 40	48 / 45 / 42	52 / 48 / 44	51 / 47 / 42
Sound Press. Level OU (dB(A)) Cool (Night) Heat	48 (48) 50	50 (48) 52	52 (50) 54	48 (44) 50	53 (50) 54
INSTALLATION					
Refrigerant Type	R410A				
Pipe Connection Sizes: Suction (mm)	16 (5/8")	16 (5/8")	16 (5/8")	16 (5/8")	19 (3/4")
Pipe Connection Sizes: Liquid (mm)	10 (3/8")	10 (3/8")	10 (3/8")	10 (3/8")	10 (3/8")
Refrigerant Pipe Charge Length (m)	20	20	30	30	30
Max. Pipe Length (m)	30	50	50	77	50
Max. Pipe Lift (m) OU Higher / OU Lower	30 / 20				
Pipe Connection Method	flare				
WORKING RANGE					
Outdoor Operating Temp. (Cooling) °C db	-5 to +46		-5 to +43		0 to +46
Outdoor Operating Temp. (Heating) °C wb	-10 to +15		-15 to +15		-8 to +15

NOTES: 1. The nominal cooling capacity is based on the JIS standard B8616:

Cooling Operation Conditions
 Indoor Air Inlet Temperature : 27°C DB, 19.0°C WB
 Outdoor Air Inlet Temperature : 35°C DB
 Heating Operation Conditions
 Indoor Air Inlet Temperature : 20°C DB
 Outdoor Air Inlet Temperature : 7°C DB, 6°C WB
 Published capacities based on Piping Length: 7.5 m.

2. The sound pressure level is based on following conditions.

Indoor Units: 1.5 m beneath the unit with discharge duct (2.0m) and return duct (1.0m) in an anechoic chamber.
 Outdoor Units: 1 m from the unit service cover surface, and 1.5 m from floor level.

Rotary Condensing Units

Model	Comp.	Nom.	Noise	Duty Watts R404a Evaporating @*			Dimensions	Pipe Size (inch) Liq. Suct	Nett kg	Electrical Data	
	Type	Hp	Rating**	-5°C	-10°C	-15°C	WxDXH mm			Supply	FLA /ph
NFR075DL	QX13	0.75	33	2000	1700	760	920 x 380 x 530	3/8 1/2	42	230v-1ph- 50hz	4
NFR100DL	QX16	1	35	2300	1950	900	920 x 380 x 530	3/8 1/2	42	230v-1ph- 50hz	5
NFR150DL	QX23	1.5	38	2780	2340	1180	920 x 380 x 530	3/8 1/2	48	230v-1ph- 50hz	6.2
NFR200DL	QX30	2	41	4000	3380	1710	920 x 380 x 530	3/8 5/8	51	230v-1ph- 50hz	7.5
NFR250DL	QX36	2.5	43	4450	3900	1900	920 x 380 x 530	3/8 5/8	52	230v-1ph- 50hz	8

Piston Condensing Units

Model	Comp.	Nom.	Noise	Duty Watts R404a Evaporating @*				Dimensions	Pipe Size (inch) Liq. Suct	Nett kg	Electrical Data	
	Type	Hp	Rating**	-10°C	-5°C	0°C	7°C	WxDXH mm			Supply	FLA /ph
NFP075DGM	CAJ9480Z-T	0.75	33	1252	1168	1698	2035	920 x 380 x 530	3/8 1/2	49	230v-1ph- 50hz	7.7
NFP100DGM	CAJ9510Z-T	1	35	1543	1803	2074	2479	920 x 380 x 530	3/8 1/2	51	230v-1ph- 50hz	8.3
NFP150DGM	CAJ4519Z-T	1.5	38	2884	3411	3917	4792	920 x 380 x 530	3/8 1/2	53	230v-1ph- 50hz	16.6
Model	Comp.	Nom.	Noise	Duty Watts R404a Evaporating @*				Dimensions	Pipe Size (inch) Liq. Suct	Nett kg	Electrical Data	
	Type	Hp	Rating**	-30°C	-25°C	-20°C	-15°C	WxDXH mm			Supply	FLA /ph
NFP075DGL	CAJ2432Z-T	0.75	33	539	708	879	1047	920 x 380 x 530	3/8 1/2	49	230v-1ph- 50hz	7.9
NFP100DGL	CAJ2446Z-T	1	35	818	1029	1256	1074	920 x 380 x 530	3/8 1/2	51	230v-1ph- 50hz	10.5
NFP150DGL	CAJ2464Z-T	1.5	38	1066	1345	1656	1991	920 x 380 x 530	3/8 1/2	53	230v-1ph- 50hz	11.3

* Duty at +50°C condensing / Duty at +32°C ambient.

** DBA @ 10m in free field conditions • manufacturer's data.

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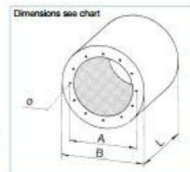
Flanged circular attenuator RSD



■ **Specification - Installation**
Casing made of galvanised steel, acoustically lined with high quality mineral wool covered with cloth to prevent erosion. Acoustic lining retained by perforated steel sheet. Dimensions and tapped flange holes of all sizes fit fan's nominal diameter (R 20). Tapped holes in accordance to DIN 24155, Pt. 2.

■ **Pressure drop**
The resistance of the RSD attenuators is very low. When designing the system consider twice the pressure drop of rigid ducting.

■ **Isolation standard**
To increase the attenuation, several attenuators can be installed in-line.



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Type	Ref. No.	Basic length	L	Dimensions in mm	Hole ø	Nominal weight kg	125	250	Isolation standard D _a dB	500	1000	2000	4000	8000	Average attenuation
RSD 225/ 300	8734	1	300	259	404	6 x M 6	7	2	5	9	14	13	8	6	8
RSD 225/ 600	8735	2	600	259	404	6 x M 6	12	4	10	17	27	25	17	14	15
RSD 225/ 900	8736	3	900	259	404	6 x M 6	17	7	13	25	33	31	20	16	20
RSD 250/ 300	8737	1	300	286	404	6 x M 6	7	3	5	8	8	9	7	5	8
RSD 250/ 600	8738	2	600	286	404	6 x M 6	12	5	10	16	24	19	14	10	15
RSD 250/ 900	8739	3	900	286	404	6 x M 6	16	6	12	22	28	21	15	11	18
RSD 280/ 400	8740	1	400	322	454	8 x M 8	10	4	5	8	14	9	8	6	8
RSD 280/ 800	8741	2	800	322	454	8 x M 8	18	7	9	16	28	18	17	14	14
RSD 280/1200	8742	3	1200	322	454	8 x M 8	25	9	12	23	37	23	20	16	18
RSD 315/ 400	8743	1	400	356	504	8 x M 8	11	3	3	7	13	8	7	5	5
RSD 315/ 800	8744	2	800	356	504	8 x M 8	19	6	8	14	26	16	12	9	12
RSD 315/1200	8745	3	1200	356	504	8 x M 8	28	9	12	21	36	18	17	14	18
RSD 355/ 400	8746	1	400	395	564	8 x M 8	13	3	4	7	11	7	6	4	6
RSD 355/ 800	8747	2	800	395	564	8 x M 8	23	6	7	13	22	14	12	8	11
RSD 355/1200	8748	3	1200	395	564	8 x M 8	33	8	11	17	29	18	15	10	17
RSD 400/ 400	8749	1	400	438	564	12 x M 8	12	3	4	6	9	7	5	3	6
RSD 400/ 800	8750	2	800	438	564	12 x M 8	21	6	6	12	18	13	12	8	9
RSD 400/1200	8751	3	1200	438	564	12 x M 8	30	7	10	14	22	18	13	9	15
RSD 450/ 400	8752	1	400	487	634	12 x M 8	17	4	5	8	10	8	7	5	8
RSD 450/ 800	8753	2	800	487	634	12 x M 8	27	6	7	13	18	13	12	9	11
RSD 450/1200	8754	3	1200	487	634	12 x M 8	38	8	10	18	23	17	14	10	15
RSD 500/ 600	8755	1	600	541	714	12 x M 8	27	4	5	9	11	9	9	6	8
RSD 500/ 900	8756	2	900	541	714	12 x M 8	36	6	8	14	16	13	13	9	12
RSD 500/1200	8757	3	1200	541	714	12 x M 8	45	8	11	22	24	17	16	12	17
RSD 560/ 600	8758	1	600	605	804	8 x M 10	32	3	5	9	9	8	8	6	8
RSD 560/1200	8759	2	1200	605	804	8 x M 10	52	6	10	19	19	16	13	10	15
RSD 630/ 600	8760	1	600	674	900	8 x M 10	44	3	5	8	8	8	7	5	8
RSD 630/1200	8761	2	1200	674	900	8 x M 10	68	5	10	16	15	15	11	8	15
RSD 710/ 600	8762	1	600	751	1000	8 x M 10	51	3	5	7	7	7	6	4	8
RSD 710/1200	8763	2	1200	751	1000	8 x M 10	80	5	10	14	13	13	10	7	15
RSD 800/ 600	8764	1	600	837	1100	12 x M 10	57	2	5	7	6	6	5	4	8
RSD 800/1200	8765	2	1200	837	1100	12 x M 10	88	5	9	13	11	11	9	6	14
RSD 900/ 900	8766	1	900	934	1220	12 x M 10	82	2	4	10	9	6	5	4	6
RSD 900/1800	8767	2	1800	934	1220	12 x M 10	135	4	9	21	17	13	9	8	14
RSD 1000/ 900	8768	1	900	1043	1350	12 x M 10	96	2	4	8	7	5	4	3	6
RSD 1000/1800	8769	2	1800	1043	1350	12 x M 10	157	4	7	16	14	10	7	6	11
RSD 1120/ 900	8770	1	900	1174	1350	12 x M 10	81	2	3	7	6	4	3	3	5
RSD 1120/1800	8771	2	1800	1174	1350	12 x M 10	136	3	6	14	11	8	6	5	9

Acoustic Performance

Noise Breakout:

The Figures below are typical of a cross section of a 200mm circular duct.

Product	Thickness mm	Barrier Weight kg/m ²	Typical Reduction in Noise Breakout dB					
			125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
MuftiLag H	12	5	1	1	8	16	18	20
	25	5	1	4	12	17	19	21
	50	5	2	6	14	18	20	23
	12	10	2	5	12	18	22	23
	25	10	4	6	16	20	24	25
	50	10	4	10	18	22	26	29
MuftiLag P	15	5	1	1	8	16	18	20
	25	5	1	4	12	17	19	21
	50	5	2	6	14	18	20	23
	15	10	2	5	12	18	22	23
	25	10	4	6	16	20	24	25
	50	10	4	10	18	22	26	29

Sound Reduction Index

Product	Barrier Weight kg/m ²	Typical Sound Reduction Index dB							
		63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
MuftiLag H	5	18	20	21	27	38	48	50	50
	10	19	22	24	32	44	50	50	50
MuftiLag P	5	21	21	22	21	32	45	48	44
	10	24	23	28	32	38	45	57	50

Dimensions, Density and Weight

Product	Nominal Thickness mm	Blanket Size mm	Density of Insulation Layer kg/m ³	Weight of Barrier Core kg/m ²	Ordering Reference
MuftiLag H	12	2000 x 1200	9.5	5	MH 1205
	25	2000 x 1200	9.5	5	MH 2505
	50	2000 x 1200	9.5	5	MH 5005
	12	2000 x 1200	9.5	10	MH 1210
	25	2000 x 1200	9.5	10	MH 2510
	50	2000 x 1200	9.5	10	MH 5010
MuftiLag P	15	2000 x 1200	24	5	MP 1505
	25	2000 x 1200	24	5	MP 2505
	50	2000 x 1200	24	5	MP 5005
	15	2000 x 1200	24	10	MP 1510
	25	2000 x 1200	24	10	MP 2510
	50	2000 x 1200	24	10	MP 5010